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To determine the advisability of offering a non-transfer biology course at Chaffey College (Calif.), selected students were studied. Those enrolled in Biology 1A during the R-semester period, Fall 1965 to Fall 1967, and those due to graduate in June 1968 without having taken a natural science course were compared by grade and aptitude. Data used were high school grades in English, mathematics, and natural science, composite score on the American College Test, declared major (transfer or non-transfer), day or evening enrollment, withdrawals, failures, completions, and class size and were included in a correlation matrix. Three groups of students were interviewed concerning their interest in a course covering about the same material as Biology 1A, but stressing teaching and demonstration rather than student participation; 80% showed an interest in such a course. Because of this interest and because biology courses are generally considered a logical beginning to the natural sciences, it was recommended that a non-transfer biology course be offered on a trial basis for 1968-69. This course would be planned for students without a science background and for those with no intention of transferring or otherwise pursuing serious science study. (HH)

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A STUDY OF THE DESIRABILITY OF OFFERING A NON-TRANSFER BIOLOGY COURSE AT CHAFFEY COLLEGE

A Paper Presented

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by

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A STUDY OF THE DESIRABILITY OF OFFERING A NON-TRANSFER BIOLOGY COURSE AT CHAFFEY COLLEGE

STATEMENT OF THE PROBLEM

Over a period of several years there appears to have been an abnormally high attrition rate and failure rate among both transfer and non-transfer students enrolled in Bilogy 1A. This is the university equivalent transfer course in biology and at present is the entry course into the Life Science area, there being no lower level non-transfer courses offered in this area. The problem is to determine what circumstances contribute to the high attrition and failure rates and if these conditions could be satisfactorily remedied in a non-transfer course.

LIMITATIONS OF THE STUDY

This study will be limited to a study of students enrolled in Biology 1A during the five semester period from the Fall of 1965 to the Fall of 1967, and to the students who will be graduating from Chaffey College in June of 1968 without having enrolled in a natural science

course at the college level.

Data used to determine student capability will be limited to the grades received in the most recent high school course attempted in English, Mathematics, Natural Science, and the composite score on the American College Test used for placement of students at Chaffey College.

The transfer or non-transfer status of a student is based on his declared major field of study at the time of his enrollment in Biology 1A.

METHOD TO BE USED

The method used in the study involved a comparison of the grades and aptitudes of biology students, both day and night, and of the grades and aptitudes of students who withdrew before completion with those of students who completed the courses. Both of these were compared with the characteristics of the students who completed the course but received a failing grade.

The failure rate of transfer students will be compared with those of non-transfer students.

The attrition and failure rates of biology students will be compared with those of students in the entire col-

lege for the same period.

Students who are to graduate in June of 1968 without having attempted a natural science course will be identified and interviewed relative to their reasons for not studying a natural science and their interest in taking a non-transfer biology course, had one been available. A sample of students who took biology and failed the course will also be interviewed with the intention of determining the cause of their failure and their interest in taking a different type of biology course.

FINDINGS

Biology is a popular offering enrolling 1499 students in twenty-five day-time sections and eight evening sections during the five-semester period of this study. The chairman of the Life Science division and the biology instructors are enthusiastic about the biology program and are justly proud of the performance of their successful students in subsequent Life Science courses and at transfer institutions.

Students seem to perceive biology classes as providing very adequate preparation for successive science courses but also as being very demanding with high grading standards.

This perception is supported by a withdrawal rate in biology sections ranging from 7.5% to 52.2%. The average for all sections is 22.8% with an average in day sections of 20.4% and in night sections of 37.5%. An amplification of these figures is available in Tables I and II.

TABLE I. WITHDRAWAL EXPERIENCE OF BIOLOGY 1A STUDENTS FOR FIVE SEMESTERS - 1965 to 1967

	Entered Class	Withdrew	% Withdrew
Day Students	1176	240	20.4%
Night Students	218	78	35.8%
All Students	1394	318	22.8%

These voluntary withdrawal figures for biology compare with a college-wide withdrawal experience during the same five-semester period of 14.9% for day students and 28.7% for night students with an average of 21.9%

TABLE II WITHDRAWAL EXPERIENCE OF CHAFFEY COLLEGE FOR FIVE SEMESTERS - 1965 to 1967

	Entered Class	Withdrew	% Withdrew
Day students	15,879	2,372	14.9%
Night students	15,949	4,584	28.7%
All students	31,828	6,956	21.9%

All withdrawal figures refer to students who actually entered classes and received some instruction. Students who enrolled but did not enter class have been excluded from the tabulation.

Students who completed the Biology 1A class, maintaining enrollment until the end of the semester and taking part in the final examination experienced a failure rate (earned grade F) of approximately 15% Day students exceeded this slightly with a 15.8% rate while evening students experienced a much lower rate of 9.3%. The much higher withdrawal rate for evening students may explain this lower failure rate as many potential failures withdraw when they recognize their status in the class.

TABLE III STUDENTS COMPLETING BIOLOGY 1A AND EARNING GRADE "F"

	Completed Class	Failed Class	% Failing
Day students	936	148	15.8%
Night students	140	13	9.3%
All students	1076	161	15.0%

During the Fall semester of 1967, the last one covered in this study, the college wide experience for all students

in all classes except Physical Education indicated a 6.6% failure rate. Physical Education grades were excluded from this average because grading in these classes tends to be on attendance, punctuality, and participation rather than on achievement.

TABLE IV STUDENTS COMPLETING THE SEMESTERS WORK AND EARNING AN "F" GRADE COLLEGE WIDE

	Completed class	Failed class	% Failed
All students	14,748	977	6.6%

This wide difference between the failure rate of students in general and those taking biology courses is not justified by the aptitude of students as measured by the American College Test. As seen in Table V below, Chaffey students generally compare favorably with junior college students nationally when rated on the ACT scale of 1 to 36 with an average of 20 considered adequate for success in baccalaureate programs. It is also apparent that they score about four points below students admitted to four-year colleges.

TABLE V AVERAGE AMERICAN COLLEGE TEST SCORES - 1965 to 1967

	English	Mathematics	Natural Science	Composite
Chaffey	16.6	16.6	18.4	17.6
All JC's	16.9	17.6	18.9	18.2
West Coast Level III (State Colleges)	20.5	21.1	22.5	22.0

That Chaffey Biology students compare favorably with the entire student body can be substantiated by the information in Table VI below which indicates that biology students score well above the college average in all four categories.

TABLE VI ACT SCORES OF DAY AND NIGHT BIOLOGY STUDENTS

	English	Mathematics	Natural Science	Composite
Day students	17.38	17.26	19.22	18.62
Night students	17.11	16.76	19.18	18.08
All students	17.36	17.22	19.21	18.58

That the current examinations, laboratory assignments, and other means of evaluating student progress discriminate on the basis of aptitude seems to be supported by the difference in high school grade point average between those who

complete the course and those who drop out before completion. Day students who complete the course have consistently higher averages in English, Mathematics, and Natural Science than do those who fail to complete the course, and the same condition prevails between the two groups of evening students.

TABLE VII GRADE POINT AVERAGES EARNED IN THE MOST RECENT HIGH SCHOOL ENGLISH, MATHEMATICS, & NATURAL SCIENCE COURSE

	English	Mathematics	Natural Science
Day students who complete Biology 1A	2.66	2.27	2.58
Day students who withdraw from Biology 1A	2.43	2.03	2.26
Night students who Complete Biology 1A	2.57	2.37	2.53
Night students who withdraw from Biology 1A	2.39	2.29	2.43

Many students who withdraw from a class without completing the semester are failing or doing poor work prior to their withdrawal. Others withdraw for a wide variety of reasons

ranging from changes in work assignment or location to illness and disinterest. Whatever the reasons for withdrawal this group represents a more able group than those who fail the course as evidenced by the figures in Table VIII.

TABLE VIII GRADE POINT AVERAGES EARNED IN THE MOST RECENT HIGH SCHOOL ENGLISH, MATHEMATICS, & NATURAL SCIENCE COURSE

	English	Mathematics	Natural Science
Day students who failed Biology 1A	2.29	1.94	2.11

Earned grades tend to reflect achievement which is often accomplished in spite of handicaps in ability, or on the other hand achievement may be impaired by non-ability handicaps such as environmental pressures. Therefore, the fact that students who withdraw or fail have measurably different aptitudes as determined by the ACT scores may be even more significant than the grade point differential. In Talbe IX it is apparent that day students who withdraw score over one full point lower on the ACT scale than do those who persist. In the evening classes the difference is much greater, averaging nearly two full points.

TABLE IX ACT SCORES OF BIOLOGY STUDENTS WHO COMPLETE THE COURSE COMPARED TO THOSE WHO WITHDRAW

	English	Mathematics	Natural Science	Composite
Day students who complete Biology 1A	17.66	17.67	19.57	18.98
Day students who withdraw from Biology 1A	16.55	16.04	18.18	17.57
Night students who complete Biology 1A	17.36	17.22	19.21	18.58
Night students who withdraw from Biology 1A	14.94	15.19	17.34	16.19

Class size is often considered a significant factor in the withdrawal rate with small classes credited with aiding in the retention of students and large classes blamed for excessive withdrawals. This was not found to be the case in the biology classes. Generally, the larger classes showed better retention with classes between 41 and 45 students having the lowest average withdrawal rate. Table X indicates a withdrawal rate ranging from 15.2% to 40% with class size indicated in increments of five.

TABLE X WITHDRAWAL RATE OF BIOLOGY CLASSES OF VARYING SIZES

Day classes	15-20 students	25 %
	21-25	
	26-30	23.1%
	31-35	
	36-40	40 %
	41-45	15.2%
	46-50	22.1%
	51-55	17.8%
Night classes	21-25 students	44.9%
	26-30	33.3%

The same pattern prevailed in the evening classes even though they were few in number and more nearly uniform in size.

The failure rate of transfer students and of non-transfer students is in nearly direct proportion to the composition of the class, as is shown in Table XI.

TABLE XI ENROLLMENT IN BIOLOGY 1A ACCORDING TO STUDENTS MAJOR

	Transfer Major	Non-Transfer Major	Unknown Major
All students enrolled in Biology 1A	87.1%	8.3%	4.6%
Students failing Biology 1A	85.1%	10.8%	4.1%

One of the original purposes of this study was to help provide a non-transfer biology course for the supposed large numbers of students who were graduating without having taken a natural science. The graduating class of 1968 was carefully surveyed and only 34 students in a class of 692 could be identified as eligible for graduation without having taken a natural science. This represents only 4.9% of the graduates. There are undoubtedly many more students who will be terminating their college career without enrollment in a natural science but there is no way of knowing when these students end their studies as they reduce their load to a single class, they "work out" and they drop out unannounced. Thus, while there seems to be little need of providing another type of biology course for graduates, the need appears to be considerable for other non-transfer students, and especially a need for a less rigorous course than the transfer oriented Biology 1A.

Three groups of students were interviewed for their reactions to a non-transfer biology course. These groups consiting of twenty students each were students who had failed Biology 1A, students who were graduating and students who were completing certificate programs or other programs without qualifying for transfer to a four-year institution. Only the students who had failed Biology 1A had any experience with any natural science course at the college level. The proposed course was described to these students as covering approximately the same material as offered in Biology 1A but with emphasis on teaching and demonstrations instead of on student participation. The proposed course would be offered in one of the new large lecture facilities taking full advantage of the variety of media available for the best possible presentation of the material to be covered. No mention was made of lowered standards or of easier grading practices.

In the two groups which had not attempted any natural science three principal reasons were given for not enrolling in science:

1. Not interested in science 20%

2. Science classes interferred with other requirements — 60%

3. Science was not required and therefore not important — 20%

In all groups of students interviewed eighty percent indicated an interest in taking a biology course of this nature. This seemed especially significant in the group which had once failed biology because only two (10%) of this group indicated any plans to repeat the course which they had failed, and neither of these had set a time for re-enrollment.

Only thirty percent of the students interviewed expressed any interest in taking a traditional non-laboratory biology course, and of this group the majority felt that they could not afford an entire afternoon per week for a laboratory class which interferred with employment or other activities including athletic and social.

As a final question all students were asked if they favored offerings the new biology course on a Credit-No Credit basis. Seventy percent indicated an interest in this possibility and several volunteered that they would like to explore courses in other areas on a Credit-No Credit basis.

Every effort was made in interviewing to be objective and to present the information, ask the questions, and record

answers before allowing the students to ask questions or make comments. In spite of this precaution a certain amount of "Hawthorne Effect" seemed to be apparent, especially among the students who had once failed biology. This group, after displaying an initial defensive coolness, seemed very pleased that their problem was receiving attention and that an alternative might be offered them.

SUMMARY AND RECOMMENDATIONS

Biology courses enjoy high enrollment and consistent popularity among students. They are considered by counselors, instructors, and students as the logical beginning science course or only science course for students without a strong background in natural science. An undesirably high percentage of apparently well-qualified students fail or withdraw from Biology 1A courses. Large class size does not seem to affect the withdrawal rate adversely. Students who have failed biology classes or who have not taken any science classes appear interested in a different type of biology course.

It is recommended that a non-transfer biology course be offered on a trial basis during the school year 1968-69.

This course should be offered in one of the new large lecture facilities with a projected enrollment of 150 students, recruited from among those not apt to choose a regular biology course or who are apt to fail such a course. Small discussion groups of no more than twenty students should also be used as needed. At least one meeting per week should be designated as a laboratory session and reserved for demonstrations of the most impressive and dramatic of the experiments appropriate to the topic. Demonstrations should be given by the instructor, a team of instructors, or possibly students who have rehearsed the demonstration and can execute it efficiently and successfully in order to have maximum impact on the observers. Lectures should make use of films, filmstrips, slides, drawings, recordings, pictures or any other devices that can contribute to a fast moving lecture with high impact on the class. Responsibility for teaching should be given to a team of instructors who are committed to this type of approach and are anxious to make it succeed.

This course should be evaluated on the basis of its ability to retain students and on student progress as compared to that of students in conventional biology classes, remembering that many of these students are of average junior college

ability, but are not equal of average four-year college students for whom Biology 1A classes are traditionally designed.

APPENDIX "A"

Biology 1A - Day Classes - Fall 1965 to Fall 1967

ction #	Total enrolled	Did Not Enter	% DNE	Did Enter	Withdrew	% W	Completed Course	% Completed	Failed	% F	Withdrew or Failed	% W or F	Earned D
105	58	5	8.6	53	4	7.5	49	92.5	15	28.3	19	35.8	9
111	50	2	4.0	48	9	18.8	39	81.2	2	4.2	11	22.9	12
114	51	3	5.9	48	7	14.6	41	85.4	1	2.1	8	16.7	15
117	52	3	5.8	49	11	22.4	38	77.6	5	10.2	16	32.7	10
105	58	3	5.2	55	7	12.7	48	87.3	5	9.1	12	21.8	9
108	21	1	4.8	20	5	25.0	15	75.0	1	5.0	6	30.0	2
111	55	5	9.1	50	10	20.0	40	80.0	2	4.0	12	24.0	11
114	53	4	7.5	49	15	30.6	34	69.4	9	18.4	24	49.0	4
117	48	5	10.4	43	8	18.6	35	81.4	13	30.2	21	48.8	7
100	55	4	7.3	51	8	15.7	43	84.3	0	0	8	15.7	9
103	54	5	9.2	49	11	22.4	38	77.6	8	16.3	19	38.8	9
106	55	5	9.1	50	5	10.0	45	90.0	8	16.0	13	26.0	8
109	54	2	3.7	52	7	13.5	45	86.5	12	23.1	19	36.5	7
112	55	5	9.1	50	15	30.0	35	70.0	7	14.0	22	44.0	2
115	27	1	3.7	26	6	23.1	20	76.9	3	11.5	9	34.6	2
100	51	0	0	51	16	31.4	35	68.6	8	15.7	24	47.1	11
105	55	1	1.81	54	10	18.5	44	81.5	1	1.9	11	20.4	10
106	50	6	12.0	44	4	9.1	40	90.9	9	20.5	13	29.5	13
109	49	3	6.12	46	11	23.9	35	76.1	12	26.1	23	50.0	3
112	44	4	9.1	40	16	40.0	24	60.0	4	10.0	20	50.0	5
105	54	2	3.7	52	7	13.5	45	86.5	0	0	7	13.5	14
108	55	5	9.1	50	13	26.0	37	74.0	8	16.0	21	42.0	9
111	48	3	6.3	45	8	17.8	37	82.2	3	6.7	11	24.4	11
115	55	4	7.3	51	15	29.4	36	70.6	3	5.9	18	35.3	9
118	53	3	5.7	50	12	24.0	38	76.0	9	18.0	21	42.0	12
tal Day	1260	81	6.7	1176	240	20.4	936	79.6	148	12.6	388	33.0	213

Biology 1A - Night Classes - Fall 1965 to Fall 1967

ection #	Total enrolled	Did Not Enter	% DNE	Did Enter	Withdrew	% W	Completed Course	% Completed	Failed	% F	withdrew or Failed	% W or F	Ex.
0120N	31	1	3.2	30	13	43.3	17	56.7	0	0	13	43.3	
0127N	23	0	0	23	12	52.2	11	47.8	2	8.7	14	60.9	
0120N	34	4	11.8	30	10	33.3	20	66.7	2	6.7	12	40.0	
0116N	31	3	9.7	28	8	28.6	20	71.4	2	7.1	10	35.7	
0117N	34	6	17.6	28	10	35.7	18	64.3	3	10.7	13	46.4	
0115N	31	2	6.5	29	6	20.7	23	79.3	1	3.4	7	24.1	
0121N	27	1	3.7	26	10	38.5	16	61.5	3	11.5	13	50.0	
0122N	28	4	14.3	24	9	37.5	15	62.5	0	0	9	37.5	
Total Night	339	21	8.8	218	78	35.8	140	64.2	13	6.0	91	41.7	2
Total Day + Night	1499	105	7.0	1394	318	22.8	1076	77.2	161	11.5	479	34.4	2

APPENDIX "B"

Biology 1A - Day Students who Completed the Course

	Age		H.S. Grades						ACT Scores							
			English		Math		Nat. Sci.		English		Math		Nat. Sci.		Comp.	
	25	431	18	64	12	54	21	58	23	421	23	418	23	485	23	456
	27	504	29	79	27	64	29	83	29	529	27	500	29	580	27	567
	15	279	15	43	15	34	12	31	16	265	16	257	16	298	16	285
	24	448	26	73	25	60	24	62	26	461	26	525	26	538	26	516
	24	443	26	62	25	53	22	54	26	430	26	426	26	506	26	479
	8	150	8	22	8	20	7	17	8	131	8	131	8	140	8	137
	25	474	26	66	24	53	24	65	26	440	26	482	26	487	26	475
	18	337	19	49	19	41	17	84	19	344	19	364	19	405	19	380
	25	477	25	63	25	53	24	61	25	395	25	393	25	399	25	420
	31	558	32	78	32	66	29	67	34	614	34	646	34	691	34	645
	31	560	32	88	32	77	29	77	35	610	33	630	33	604	33	633
	35	647	36	100	34	75	33	82	36	671	36	692	36	713	36	704
	33	598	33	95	32	68	33	78	33	628	33	587	33	673	33	656
	30	568	30	72	29	77	29	69	30	535	30	484	30	592	30	571
	19	320	19	51	18	43	17	44	19	361	19	319	19	525	19	360
	31	568	31	80	31	70	27	68	31	569	31	571	31	543	31	558
	37	667	37	95	37	85	32	89	37	629	37	610	37	724	37	685
	36	663	36	100	34	80	36	78	36	629	36	677	36	697	36	688
	25	459	24	64	23	50	22	49	25	482	25	434	25	472	25	469
	19	353	19	51	19	42	18	45	19	353	19	357	19	400	19	388
	36	665	37	101	37	82	37	104	37	647	37	611	37	782	37	709
	23	502	24	77	23	68	23	57	24	542	24	498	24	501	24	516
	28	535	27	78	27	62	28	74	28	480	28	463	28	526	28	519
	25	463	27	82	27	66	26	64	28	500	28	465	28	565	28	548
	26	455	26	59	26	58	25	52	26	437	26	451	26	494	26	469
		10327				1231		2041		12112		12282		17447		16202
		377				613		632		702		702		702		702
		18.58				2.21		3.68		17.26		17.26		24.85		18.6

c.	Age	H.S. Grades						ACT Scores							
		English		Math		Nat. Sci.		English		Math		Nat. Sci.		Comp.	
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4	73	5	11	5	10	5	14	5	91	5	90	5	87	5	91
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	6	114	6	14	6	11	6	17	6	107	6	103	6	112	6	111
5	8	152	9	22	9	13	6	11	9	135	9	129	9	144	9	139
9	2	32	2	4	1	3	2	4	3	56	3	45	3	60	3	60
	9	168	9	23	9	17	9	23	7	145	9	128	9	162	9	152
2	13	240	15	35	15	29	12	34	15	270	15	242	15	287	15	267
7	6	112	6	12	6	8	5	14	6	102	6	82	6	119	6	111
0	10	183	10	26	10	22	8	19	10	189	10	205	10	220	10	198
3	13	215	14	38	12	37	13	31	14	256	14	322	15	282	15	269
6	7	129	7	20	7	12	7	17	7	108	7	110	7	109	7	111
9	9	162	9	21	8	15	9	22	9	154	9	139	9	154	9	157
2	11	268	11	36	14	33	12	26	11	192	11	182	12	223	11	204
5	6	109	6	14	6	10	5	8	6	98	6	103	6	104	6	104
0	15	271	15	35	13	37	12	31	15	256	15	235	15	255	15	253
3	10	183	10	25	7	14	8	22	10	151	10	150	10	161	10	161
6	7	136	8	19	8	17	8	17	8	138	8	134	8	160	8	152
9	10	193	10	31	10	23	9	22	10	160	10	202	10	208	10	196
2	13	287	14	40	15	31	12	31	13	249	13	243	13	311	13	317
5	8	142	7	16	6	16	7	18	8	143	8	121	8	139	8	144
8	15	220	15	37	15	33	14	32	15	258	15	278	15	304	15	288
	5	117	5	14	5	9	5	14	5	80	5	87	5	83	5	84
1	14	361	15	44	15	32	13	36	13	248	15	215	15	276	15	259
2	10	197	11	23	11	23	10	23	11	154	11	188	11	204	11	190

ec.	Age	H.S. Grades			ACT Scores			
		English	Math	Mat. Sci.	English	Math	Nat. Sci.	Comp.
	3 38	3 8	3 6	3 8	3 53	3 48	3 10	3 60
	5 91	5 11	5 9	4 6	5 97	5 90	5 91	5 91
	4 75	4 10	4 12	4 10	4 72	4 72	4 63	4 71
	3 64	4 10	3 10	3 9	4 80	4 51	4 64	4 69
	5 91	6 16	6 15	6 15	6 119	6 103	6 129	6 119
	6 170	7 21	7 16	7 20	7 133	7 139	7 166	7 153
	7 136	7 17	7 17	7 17	7 121	7 132	7 131	7 128
	6 112	6 15	6 12	6 16	6 113	6 119	6 150	6 129
	137	104	97	[illegible]	758	[illegible]	[illegible]	[illegible]
	42	42	41	40	42	42	42	42
	3.26	2.48	2.41	2.53	3.76	17.85	3.81	18.02
1	1343	1821	1681	1683	12466	12419	14119	13381
	37	73	72	68	74	74	74	74
ght	22.19	2.49	2.92	2.49	17.11	16.36	19.18	18.08
dents								
1	17733	2521	2077	2250	17649	16912	18568	16241
	946	972	945	900	972	982	982	982
dents	18.69	2.59	2.22	2.50	17.36	17.22	18.21	18.50

Biology 1A - Night Students Who Did Not Complete the Course

c.	Age		H.S. Grades						ACT Scores							
			English		Math		Nat. Sci.		English		Math		Nat. Sci.		Comp.	
2N	1	19	1	2	1	3	1	2	1	6	1	8	1	2	1	6
N	4	77	11	10	4	7	11	10	4	71	4	64	4	82	4	73
N	7	129	6	14	6	9	5	11	7	118	7	114	7	136	7	131
N	4	83	4	8	4	11	4	8	4	48	4	50	4	63	4	55
N	7	139	8	17	8	22	6	15	8	94	8	108	8	100	8	97
N	3	53	3	9	3	9	3	7	3	60	3	53	3	63	3	61
N	3	65	3	7	3	7	3	9	3	65	3	61	3	80	3	72
N	2	41	2	5	2	3	2	6	2	16	2	27	2	23	2	23
	31	2.37	31	2.32	31	2.29	31	2.23	32	14.44	32	17.34	32	16.12		